THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A nanotube with one or more nucleic acid molecule(s) attached thereto.

2. A method of chemically modifying a nanotube comprising the steps of:

(a) chemically attaching at least one linker attached to one or more nucleic acid molecules to an optionally functionalised nanotube, wherein said linker consists wholly or partly of a functional group with the proviso that when the nanotube is functionalised with CO_2H, then the linker is not a primary aliphatic alkyl amine; or

(b) chemically attaching at least one linker attached to one or more nucleic acid molecule to an optionally functionalised nanotube, wherein said linker consists wholly or partly of a functional group; and

(c) synthesising at least two nucleic acid molecules, by sequential addition of nucleotides *in situ*, starting from said one or more nucleic acid molecules; or

(d) chemically attaching at least one linker to an optionally functionalised nanotube, wherein said linker consists wholly or partly of a functional group; and

(e) attaching one or more nucleic acid molecules to said optionally functionalised nanotube via said functional group on said linker; or

(f) synthesising one or more nucleic acid molecules, by sequential addition of nucleotides *in situ*, starting from said functional group on said linker.

3. A method of chemically modifying a nanotube comprising the steps of:

a) photochemically attaching at least one linker attached to one or more nucleic acid molecules to an optionally functionalised nanotube, wherein said

linker consists wholly or partly of a functional group; or

b) photochemically attaching at least one linker attached to one or more nucleic acid molecules to an optionally functionalised nanotube, wherein said linker consists wholly or partly of a functional group; and

c) synthesising at least two nucleic acid molecules by sequential addition of nucleotides *in situ*, starting from said one or more nucleic acid molecules; or

d) photochemically attaching at least one linker to an optionally functionalised nanotube, wherein the linker consists wholly or partly of a functional group; and

e) attaching one or more nucleic acid molecules to said optionally functionalised nanotube via said functional group on said linker; or

f) synthesising one or more nucleic acid molecules, by sequential addition of nucleotides *in situ*, starting from said functional group on said linker.

4. A method of physically modifying a nanotube comprising the steps of:

a) physically adsorbing at least one anchor attached to one or more nucleic acid molecules to the surface of an optionally functionalised nanotube, wherein said anchor consists wholly or partly of a functional group; or

b) physically adsorbing at least one anchor attached to one or more nucleic acid molecules to the surface of an optionally functionalised nanotube, wherein said anchor consists wholly or partly of a functional group; and

c) synthesising at least two nucleic acid molecules by sequential addition of nucleotides *in situ*, starting from said

functional group on said anchor; or

d) physically adsorbing at least one anchor to the surface of an optionally functionalised nanotube, wherein said anchor consists wholly or partly of a functional group; and

e) chemically attaching one or more nucleic acid molecules to said functional group on said anchor adsorbed on the optionally functionalised nanotube; or

f) synthesising one or more nucleic acid molecules, by sequential addition of nucleotides *in situ*, starting from said functional group on said anchor.

5. A method of linking nanotubes comprising the steps of:

a) attaching a first nucleic acid molecule of a first base sequence to a first optionally functionalised nanotube; and

b) hybridising the first nucleic acid molecule with a second nucleic acid molecule of a second base sequence attached on a second optionally functionalised nanotube, wherein the base sequence of the second nucleic acid molecule is substantially complementary to the base sequence of the first nucleic acid molecule.

6. A method of linking nanotubes comprising the steps of:

a) attaching a first nucleic acid molecule of a first base sequence to optionally functionalised nanotubes; and

b) hybridising the first nucleic acid molecule with a second nucleic acid molecule which comprises a base sequence substantially complementary to the first base sequence and further comprises a second or a third base sequence which is/are not complementary to the first base sequence, but is/are complementary to each

other.

7. A method of linking nanotubes comprising the steps of:

a) attaching a first nucleic acid molecule of a first base sequence to a first optionally functionalised nanotube;

b) attaching a second nucleic acid molecule of a second base sequence to a second optionally functionalised nanotube;

c) hybridising the first nucleic acid molecule to a third nucleic acid molecule which comprises a base sequence substantially complementary to the base sequence of the first nucleic acid molecule and which further comprises at least 5 nucleotides which are not complementary to the base sequence of the first or second nucleic acid molecules;

d) hybridising the second nucleic acid molecule to a fourth nucleic acid molecule which comprises a base sequence substantially complementary to the base sequence of the second nucleic acid molecule and which further comprises at least 5 nucleotides which are not complementary to the base sequences of the first or second nucleic acid molecules;

wherein the base sequences of the third and fourth nucleic acid molecules are substantially complementary such that under stringent hybridisation conditions said third and fourth nucleic acid molecules hybridise thereby linking said first and second optionally functionalised nanotubes.

8. A method of linking nanotubes comprising the steps of:

a) providing a plurality of optionally functionalised nanotubes with attached nucleic acid molecules, wherein said nucleic acid molecules have the same or different base sequences;

b) exposing said optionally functionalised

nanotubes to a nucleotide strand which comprises a base sequence substantially complementary to one or more of the base sequences of said nucleic acid molecules; and

c) incubating said optionally functionalised nanotubes and nucleotide strand under appropriate hybridisation conditions wherein said optionally functionalised nanotubes are linked via hybridisation of the nucleic acid molecules with the nucleotide strand.

9. A plurality of linked nanotubes.

10. Linked nanotubes produced by a method according to any one of claims 5 to 8.

11. A method for directing nanotubes to specific targets comprising the steps of:

a) attaching a first nucleic acid molecule of a first base sequence to optionally functionalised nanotubes;

b) attaching a second nucleic acid molecule of a second base sequence which is substantially complementary to the first base sequence to a target; and

c) hybridising said first and second nucleic acid molecules.

12. A method for directing nanotubes to specific targets comprising the steps of:

a) attaching a first nucleic acid molecule of a first base sequence to an optionally functionalised nanotube;

b) attaching a second nucleic acid molecule of a second base sequence to a target;

c) exposing said nanotube and target to a third nucleic acid molecule which comprises a base sequence which is substantially complementary to both the first and second nucleic acid molecules; and

d) incubating said optionally functionalised

nanotube and target under appropriate hybridisation conditions wherein said optionally functionalised nanotube and target are linked via hybridisation of the first and second nucleic acid molecule via the third nucleic acid molecule.

13. A method for directing nanotubes to specific targets comprising the steps of:

a) attaching a first nucleic acid molecule of a first base sequence to an optionally functionalised nanotube;

b) attaching a second nucleic acid molecule of a second base sequence to a target;

c) hybridising the first nucleic acid molecule to a third nucleic acid molecule which comprises a base sequence substantially complementary to the base sequence of the first nucleic acid molecule and which further comprises at least 5 nucleotides which are not complementary to the base sequence of the first or second nucleic acid molecules;

d) hybridising the second nucleic acid molecule to a fourth nucleic acid molecule which comprises a base sequence substantially complementary to the base sequence of the second nucleic acid molecule and which further comprises at least 5 nucleotides which are not complementary to the base sequences of the first or second nucleic acid molecules;

wherein the base sequences of the third and fourth nucleic acid molecules are substantially complementary such that under stringent hybridisation conditions said third and fourth nucleic acid molecules hybridise thereby directing said optionally functionalised nanotube to said target.

14. A method for directing nanotubes to specific targets comprising the steps of:

a) attaching a first nucleic acid molecule of a first base sequence to optionally functionalised

nanotubes;

b) attaching a second nucleic acid molecule of a second base sequence to a target, where the second base sequence is not complementary to the first base sequence, and where the second base sequence may or may not be the same as the first base sequence, and

c) adding a third nucleic acid molecule which has in one part a base sequence substantially complementary to the base sequence of the first nucleic acid molecule and in another part a base sequence substantially complementary to the base sequence of the second nucleic acid molecule; and

d) hybridising the third nucleic acid molecule to the first and the second nucleic acid molecules, thus linking the optionally functionalised nanotube to the target.

15. A method for directing nanotubes to specific targets comprising the steps of:

a) attaching a first nucleic acid molecule of a first base sequence to optionally functionalised nanotubes; and

b) hybridising the first nucleic acid molecule with a second nucleic acid molecule which comprises a base sequence substantially complementary to the first base sequence and further comprises a second or a third base sequence which is/are not complementary to the first base sequence, but is/are complementary to each other.

16. A nucleic acid sensor comprising a nanotube with one or more nucleic acid molecule(s) attached thereto, wherein the base sequence of the said attached nucleic acid molecule is substantially complementary to all or a portion of the base sequence of the nucleic acid molecules being detected.

17. A sensor according to claim 16, wherein the sensor consists of an array of groups of one or more nanotubes, each group having one or more nucleic acid molecules of the same base sequence attached to each nanotube in the group, and where the base sequence of the nucleic acid molecules attached to the nanotubes in one group differs from those in other groups so that a number of different target DNA molecules may be detected.

18. A DNA array consisting of an array of groups of one or more nanotubes, each group having one or more nucleic acid molecules of the same base sequence attached to each nanotube in the group, and where the base sequence of the nucleic acid molecules attached to the nanotubes in one group differs from those in other groups so that a number of different target DNA molecules may be detected.

19. An actuator comprising one or more nanotubes with one or more nucleic acid molecule(s) attached thereto and a membrane support to which the DNA-modified nanotubes are attached.

20. A conductor comprising one or more nanotubes with one or more nucleic acid molecule(s) attached thereto.

21. A conductor according to claim 20, wherein the conductor is a nanowire comprised of nanotubes linked together via nucleic acid hybridisation.

22. A conductor according to claim 21, wherein the nanowire further comprises nanoparticles or coating of conductive material.

23. A method according to any one of claims 2 to 8, 11 to 15, wherein the nanotubes are carbon nanotubes.

24. A method according to claim 23, wherein carbon nanotubes are grown using a method selected from the group consisting of Arc discharge method, chemical vaporisation deposition method (CVD), plasma enhanced chemical vaporisation deposition method (PECVD), laser ablation/vaporization, pyrolysis, thermal chemical vapour deposition, electrolysis and flame synthesis, or a combination of thereof.

25. A method according to any one of claims 2 to 8, 11 to 15, wherein the first, second, third or fourth nucleic acid molecules are selected from the group consisting of DNA, cDNA, RNA, oligonucleotide, oligoribonucleotide, modified oligonucleotide, modified oligoribonucleotide and peptide nucleic acid (PNA), or hybrid molecules thereof.

26. A method according to any one of claims 2 to 8, 11 to 15, wherein the nucleic acid molecule is an oligonucleotide, oligoribonucleotide or RNA-DNA hybrid molecule thereof.

27. A method according to any one of claims 2 to 8, 11 to 15, wherein the nucleic acid molecule is an oligonucleotide.

28. A method according to any one of claims 2 to 8, 11 to 15, wherein the nucleic acid molecule is synthesised in a DNA synthesiser or produced by enzymatic digestion or enzymatic polymerisation and then attached onto the optionally functionalised nanotube.

29. A method according to claim 28, wherein the nucleic acid is attached by reacting the nucleic acid molecule with an optionally functionalised nanotube modified with a functional group or with a nanotube physically modified with an anchor containing a functional

group.

30. A method according to any one of claims 2 to 8, 11 to 15, wherein the nucleic acid molecule is synthesised *in situ* onto a functionalised nanotube or onto a nanotube physically modified with an anchor containing a functional group.

31. A method according to claim 29, wherein the synthesised nucleic acid molecule is attached to a nanotube modified with carboxyl groups either by oxidation or by photo-irradiation of an azido linker containing carboxyl groups.

32. A method according to claim 31, wherein the carboxyl group on the nanotube or on the azido linker forms an amide bond with 5' or 3'amino modified DNA.

33. A method according to claim 32, wherein the amide bond is extended by incorporating a spacer between the DNA and the linker by using difunctional reagents or non-standard amino acids (C3-C12).

34. A method according to claim 33, wherein the difunctional reagent is one or more amino acids.

35. A method according to claim 34, wherein the non-standard amino acid is 11-amino undecanoic acid.

36. A method according to any one of claims 2 to 8, 11 to 15, wherein the nucleic acid molecule is synthesised *in situ* by either oxidizing nanotubes to form hydroxyl groups or attaching functional hydroxyl groups to the nanotubes using photochemical reaction of azido compounds.

37. A method according to claim 36, wherein the azido compound is azido thymidine or azidoadenosine.

38. A method according to any one of claims 2 to 8, 11 to 15, wherein the DNA is physically attached to the nanotube via a covalent linkage to an anchor which is physically adsorbed to the surface of the nanotube.

39. A method according to claim 38, wherein the DNA is either pre-synthesised or synthesised *in situ*.

40. A method according to claim 38 or claim 39, wherein the anchor typically contains a hydrophobic domain which interact strongly with the hydrophobic walls of the nanotube, and a functional group to which the DNA can be attached or built-up from.

41. A method according to claim 38 or claim 39, wherein the anchor is an oligonucleotide spacer which physically adsorbs to the nanotube walls and from which extends the hybridizing DNA.

42. A method according to claim 41, wherein the oligonucleotide spacer is oligo thymidine or oligo guanidine.

43. A method according to any one of claims 2 to 8, 11 to 15, wherein the nucleic acid molecule is attached to the walls(s), side(s) and/or tip(s) of the nanotube.

44. A method according to any one of claims 2 to 8, 11 to 15, wherein the carbon nanotubes are linked end-to-end, side-to-side, or combinations thereof.

45. A method according to claim 44, wherein the linking process utilises the unique self-annealing properties of nucleic acids.

46. A method according to claim 45, wherein the

linking process involves the attachment of a single-stranded nucleic acid molecule to the side or end of a first nanotube, and the attachment of a complementary single-stranded nucleic acid molecule to the side or end of a second nanotube, wherein, under appropriate hybridisation conditions, the nucleic acid molecules hybridise together thereby linking the nanotubes.

47. A method according to claim 46, wherein the linking process involves the attachment of a first single-stranded nucleic acid molecule to the side or end of carbon nanotubes.

48. A linked nanotube according to claim 9 or claim 10, further comprising other nanoparticles.

49. A linked nanotube according to claim 48, wherein the nanoparticles are selected from the group consisting of spheres, rods and octahedrons.

50. A linked nanotube according to claim 49, wherein the nanoparticles are made of gold, silver, and cadmium sulphide (CdS).

51. One or more nanotubes comprising one or more nucleic acid molecule(s) attached thereto further comprising a plurality of nanoparticles hybridized to said nucleic acid molecules by complementary nucleic acid molecules attached to said nanoparticles, wherein said nanotubes are coated with nanoparticles.

52. A method of coating one or more nanotubes with nanoparticles comprising the step of exposing one or more nucleic acid molecule(s) attached to said nanotubes to nanoparticles comprising a plurality of complementary nucleic acid molecules attached thereto, wherein said nanoparticles hybridize to the nucleic acid molecules on the surface of the nanotube(s) as well as self-annealling to other nanoparticles thereby forming one or more coated nanotubes.